

OLIVE CULTURE IN THE UNITED STATES.

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THE OLIVE REGION OF THE UNITED STATES.

The true North American olive belt—the region especially adapted to the growth and production of this fruit—includes a portion of Mexico proper, all of Lower California, and much of the State of California, exclusive of the mountain tops. There is another large section of the United States where the olive will grow, but which is not specially adapted to its extensive and successful cultivation. This region includes parts of Arizona, Texas, Louisiana, Mississippi, Alabama, Florida, Georgia, South Carolina, and probably also small portions of southwestern Utah and southwestern Nevada. The region particularly adapted to olive culture is, as already indicated, on the Pacific Slope, and this constitutes one of the largest and finest olive areas in the world.

The olive belt included within California is from 600 to 700 miles long and varies in width from 30 to 125 miles or more. If this belt were cut down to a width of 20 miles, which is greatly below its real average, and to a length of 500 miles, it would represent an area of 6,400,000 acres, or more than twice the area, according to official returns, of the land now set to olives in Spain, the most extensive olive-growing country in the world. This area adapted to olives within a single State embraces southern California and the region west of the Sierra Nevadas as far north as the upper portion of the Sacramento Valley and along the coast valleys and coast ranges to some distance north of San Francisco.

THRIFT AND LONGEVITY OF THE OLIVE IN CALIFORNIA.

The longevity of the olive in the Old World is proverbial. The olive tree also grows remarkably well on the Pacific Coast, and it is believed that in that part of the United States the conditions are well adapted to its continued wants. The experience of the Mission Fathers certainly leads to this conclusion. The olive was introduced at the San Diego Mission from Lower California soon after 1769, and between that date and 1823 it was planted in most of, if not all, the twenty-one missions of the coast. So far as known, the largest early plantings were made at San Diego and San Fernando, although some of the

oldest trees are to be found at Capistrano. It is stated that 500 trees were planted at San Fernando about the year 1800, and at present about 450 of them are in a fairly thrifty condition. Probably none of the California trees have reached a diameter of much more than 2 feet, a fact which emphasizes the great age of the monster olive trees of the Mediterranean region.

PRESENT ACREAGE.

The acreage of olives on the Pacific Coast can not be accurately given, but it runs well up among the thousands. Some idea may be had of the growth of this industry from the fact that in 1894 over 400,000 olive trees were sold for planting from the nurseries of Pomona, Cal., alone, while the shipments and orders for the first half of 1895 amounted to 500,000 trees. In June of the year named it was estimated that 600,000 olive trees would be planted in California in 1895. If this number of trees were set as close as 20 feet, they would then represent an increase of olive culture to the extent of over 9,000 acres in two years.

THE OUTLOOK.

Olive culture has ever been among the foremost branches of horticulture in the portions of the Old World suited in climate to the growth of the tree. Spain alone has an olive acreage nearly as great as the area of the State of Connecticut and more than twice the area of Delaware, although that country is but one-fifteenth the size of the United States.

Some idea of the possible monetary value of olive growing to the United States may be drawn from the extent and value of the industry in other countries. From the latest and most conservative and official data it is estimated that the value to the United States of a yield of olive oil equaling in amount the annual yield of Spain, if sold at prices brought by the French product, would be \$80,000,000 per annum. So far as climate, soil, and ability to manufacture the products are concerned, there is nothing to prevent our attaining this magnificent result.

The amount of olive products that will eventually be consumed by the United States will be very large, as in most of its forms the olive gives a very healthful and nourishing food. The oil of the olive is the finest obtainable, both for table and for kitchen use, while as a pickle and food for daily consumption the olive excels all other plants, especially when the fruit is allowed to mature and fill with oil before being preserved. Americans are naturally fond of pickles of all kinds, and the taste for the ripe olive pickle when once acquired leads to its constant use when the supply and the price are within the reach of the consumer. Good evidence of this is seen in the fact that few olives are at present shipped from the olive-growing sections of the

Pacific Coast, as they are mostly consumed where produced. The Spanish experience also demonstrates this. The estimated annual yield of olive oil in Spain is 78,627,136 gallons. Of this large quantity it is said that only about 10,000,000 gallons are exported, the remainder being consumed at home by a population which is only one-third that of the United States. Extensive use is also made of olive oil in pharmacy, in the manufacture of soaps, and for preserving sardines. Such facts show why the olive and its products have been so highly appreciated for thousands of years in olive-growing countries.

NEEDS OF OUR OLIVE INDUSTRY.

A careful review of the olive industry of the United States will show that it can easily be placed in a condition to enable it to assume in a few years a prominent and even a foremost position among the horticultural interests of the country. The one great need to-day is legislative action which will prevent the sale within the United States of other oils under the name of olive oil. Place the industry upon this equitable and necessary footing, and the growers of the olive in this country will rapidly gain control of the American market and the industry will assume its rightful and leading position. This result must almost necessarily follow from the fact that the production of pure olive oil in Europe is scarcely sufficient to supply European demand. If the producers could not, as at present, sell us peanut oil and cotton-seed oil under the name of olive oil and charge for it olive-oil prices, American dealers would have to supply the demands of consumers with the pure American product, provided, of course, the law had universal application. If cotton-seed oil were desired by the people, it could then be had at its true value, being sold under its own name by the American firms producing it, whereas now it is shipped to Europe by these firms, reshipped to this country as the product of the olive, and foisted upon the American public as "pure olive oil." Many who pay for olive oil and suppose they are using it have perhaps never tasted the pure article. This statement, which may at first seem exaggerated, is undoubtedly true in very many cases, and should stimulate the consumer to procure the California product that he may be assured of its purity, the California laws being very strict in the matter of oil adulteration. To secure the best the brand of some well-known grower should be selected.

METHODS OF PROPAGATING THE OLIVE.

The olive is propagated in many ways. Its production from the pit is, not yet common in the United States, though several growers in California have started large numbers of seedling trees. It is somewhat difficult to germinate olive pits, and the seedling plants do not come true to name. A seedling olive, like a seedling peach, is usually suitable only as a stock upon which to graft. As the finer varieties

of olives become more extensively grown it is probable that grafting them upon wild roots will be found advantageous and become more general. In Europe many of the finer varieties are so grown.

The habit of the olive to vary from the parent plant when grown from the seed is valuable and admits of the selection of desirable qualities. The great economic value of some of the seedlings produced in California, as those of the peach, almond, walnut, etc., shows that it is advisable to select and bring to fruitage those seedling olives which give the best prospects of value through the characters of the foliage and the habit of growth.

When it is desired to grow olive seedlings, the oil of the pits should first be removed by soaking them for a few hours in weak lye or some other weak alkaline solution. After passing through this preparatory treatment, the pits may be stratified in sand and afterwards planted, much in the same way as grape seed is treated by many growers.

A new and important method of propagating the olive, which has been considerably developed in California within the past decade, is rooting small cuttings in sand in a hothouse. This system was first tried, as the writer is informed, about 1884 at the Berkeley Experiment Station. Some varieties are more easily rooted than others. The time to plant the little cuttings in the hothouse is during the late autumn and winter. From three to eight months are required to root them, according to the prevailing conditions of temperature and moisture and the variety which is being rooted. A little bottom heat is required while rooting most varieties, but some of the more easily rooted ones may be started under glass without heat, or even in a cold frame or lath house. Well-matured twigs, of about the diameter of a match and about 3 inches long, are selected for this purpose. These are stuck into the sand about one-half their length and all leaves removed except the uppermost two.

Much care is necessary in the management of these cuttings. One propagator writes: "Nothing is better calculated to take the conceit out of a nurseryman than the result of his first attempt to root olive cuttings under glass." The rooted cuttings may be planted out in nursery rows during the spring, summer, or autumn. By this method well-rooted and vigorous trees are produced, some of which have yielded fruit four years from the time the little twigs were planted in the sand.

Among the more easily rooted varieties are Mission, Nevadillo, Blanco, Oblonga, Manzanillo, and Redding Picholine. The last-mentioned variety is rooted extensively in cold frames. In fact, millions of olive twigs are now rooted annually by this process, and so largely has it superseded other methods that probably three-fourths of all the olive trees propagated each year in the United States are now rooted by this system.

A third system of propagation is by means of stools (fig. 90). This system is best adapted to those varieties which most readily produce a large number of long and rapidly growing shoots when cut back. The stocks designed for this purpose are set in rows 4 by 8 feet, and are cut back so as to induce them to send up numerous shoots from the ground level. When these sprouts are sufficiently long, they are separated and one-half of them turned down each way toward the adjoining stools of the same row, where they are bent and pinned down into transverse trenches which have been previously dug on either side of the stool to receive them. Before being pinned in these trenches the under side of each of these shoots is so cut as to cause quite a portion of the shoot to spring away from the main attached part when the shoot is bent into the trench. It is from this downward-projecting portion that the roots usually have their origin. After the cut is made and the shoot is pinned into the trench, the end



FIG. 90.—Rooting the Mission olive by the stool system.

of the shoot is turned upward, and the trench is packed full of earth as soon as all the shoots on that side of the stool are properly cut and pinned down. This work may be done in the spring or summer, the shoots being left buried until each has formed a good and abundant root system of its own. Usually from ten to twenty plants are obtained from a stool every two years. The Mission, Redding Picholine, and wild olives are especially suited to this mode of propagation.

While most of the olive trees now sold to growers are rooted by one or the other of the preceding systems, there are numerous other methods of propagation, some of them very common and time-worn. One of these is to bury olive limbs in a horizontal position in moist soil at a depth of 4 to 6 inches, cutting away and planting the rooted sprouts which they will send up. Another way is to saw large olive limbs into sections about 2 feet long, split into two to four pieces, and plant these truncheons in the nursery or directly in the orchard. A

third way is to cut out and plant in the nursery the hemispherical, knot-like swellings which are commonly found about the base of olive trees, watering them from time to time. A fourth way is to gouge out suckers from the parent tree and plant in the nursery, where they will root, provided enough of the wood of the parent stock is retained to prevent too rapid drying out.

GRAFTING THE OLIVE.

The grafting of the olive is now being extensively undertaken in California. If desired, the olive may be grafted upon hardy roots when the stock has become an inch in diameter, or the limbs of old trees may be grafted over, much as one would graft over an old pear or apple tree. Crown grafting of the semiwild Redding Picholine nursery stock has been practiced for several years by Mr. Rock with the most uniform success. In this case the stocks, which are usually grafted, average about 1 inch in diameter at the ground and are set about 1 foot apart in the nursery rows, the rows themselves being about $3\frac{1}{2}$ feet apart, or sufficiently far for convenient cultivation. About the middle of March the trees are sawed off as nearly even with the surface of the ground as possible. The earth is then drawn away from the trees until about 4 inches of the stock is exposed. The grafts are inserted as soon as possible after the removal of the tops. The cut for the insertion of the scion is made near one side of the stock, the knife being held at such an angle that the cut is deep near the operator and runs out before reaching the opposite side. The knife is also directed inward toward the center of the stock in such a way as to cut across the grain. In this way the splitting of the stock is avoided when the scion is forced tightly into place. The taper of the scion should be thick and long at one edge and thinner and shorter at the other. More wood should be cut from one side than from the other, so that the cut on one side will not enter the pith, but leave the wood on that side of the scion smooth and hard from one edge to the other. When thus cut, there is no danger of the scion splitting when forced tightly into the cleft. In setting the scion the thick edge of the taper should be outward, so that the wedge and cleft shall agree, and the pith side of the scion should be toward the center of the stock. The stock is then tightly wound with common cotton twine, in an open manner, there being from four to six turns made about it. All of the cut surfaces of the scion and stock should be carefully waxed and the earth should then be drawn back about the stocks so that the stock and scion are both nearly or quite covered.

The T-budding, or shield budding, of the olive may be practiced if desired in working over the trees.¹

As regards the growth of olives worked on hardy roots, the writer has seen Uvaria olives thus grafted which were higher than a man's head after three years from the time of grafting.

¹ For details, see Report California State Board of Horticulture, 1889.

BEST LOCATION FOR THE ORCHARD.

In the Mediterranean countries olives are grown under a great variety of cultural and soil conditions, from the barren tops of high hills to the bottoms of level and fertile valleys. It is hardly necessary to say that the olive, like other fruit trees, will grow most vigorously in a rich, deep, friable, and well-cultivated soil. The olive is greatly benefited by thorough cultivation and by manuring, although it will grow and produce in uncultivated soil and often without artificial fertilizing. The olive will make the largest growth in deep, loose valley soil, but it should not be set on wet land. Valley cultivation of the olive is already too widely practiced in California to require further comment. The subject of hillside culture is the topic here most deserving of attention.

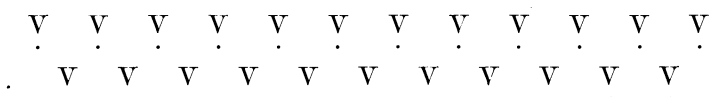
CULTURE OF THE OLIVE ON DRY HILLSIDES.

There is in California an immense area of hillside situations where the soil is fertile and the climate suited to olive culture, but where the moisture is not sufficient to enable the owners to grow other crops.

The profitable use of these dry hillsides is a subject of great interest to a large number of California fruit growers. Ranges of these hills extend for 700 miles through the State from north to south, and at present they are almost barren of crops of any kind. Millions of acres of the most fertile soils in the most equable climate are awaiting the intelligence of the cultivator to make them of permanent value. Can these hillsides be used for olive culture? An examination of the conditions under which the olive is grown in parts of the Old World strongly indicates that they can.

The rainfall conditions at Syracuse, Sicily, are much like those of the California regions under consideration. This is shown by the fact that the Mediterranean coast a few miles north of Syracuse is lined with great piles of solar salt, made by the evaporation of sea water in shallow basins along the shore. To those acquainted with the slowness of solar evaporation this will demonstrate the total absence or at least the very limited quantity of rainfall during the summer months. Moreover, raisins are made in the valley of Syracuse and the lemon groves are irrigated as in California. These facts show that the summers of Syracuse are long and dry—in fact nearly or quite as dry as those of southern California. Observation has taught the writer that the olive thrives everywhere in this region without irrigation. In the southeastern part of Sicily, where no irrigation of the olive is practiced and where the climatic or rainfall conditions are very similar to those prevailing in the drier portions of California, this tree grows to an enormous size and is perfectly healthy even to the very top of dry and otherwise barren hills.

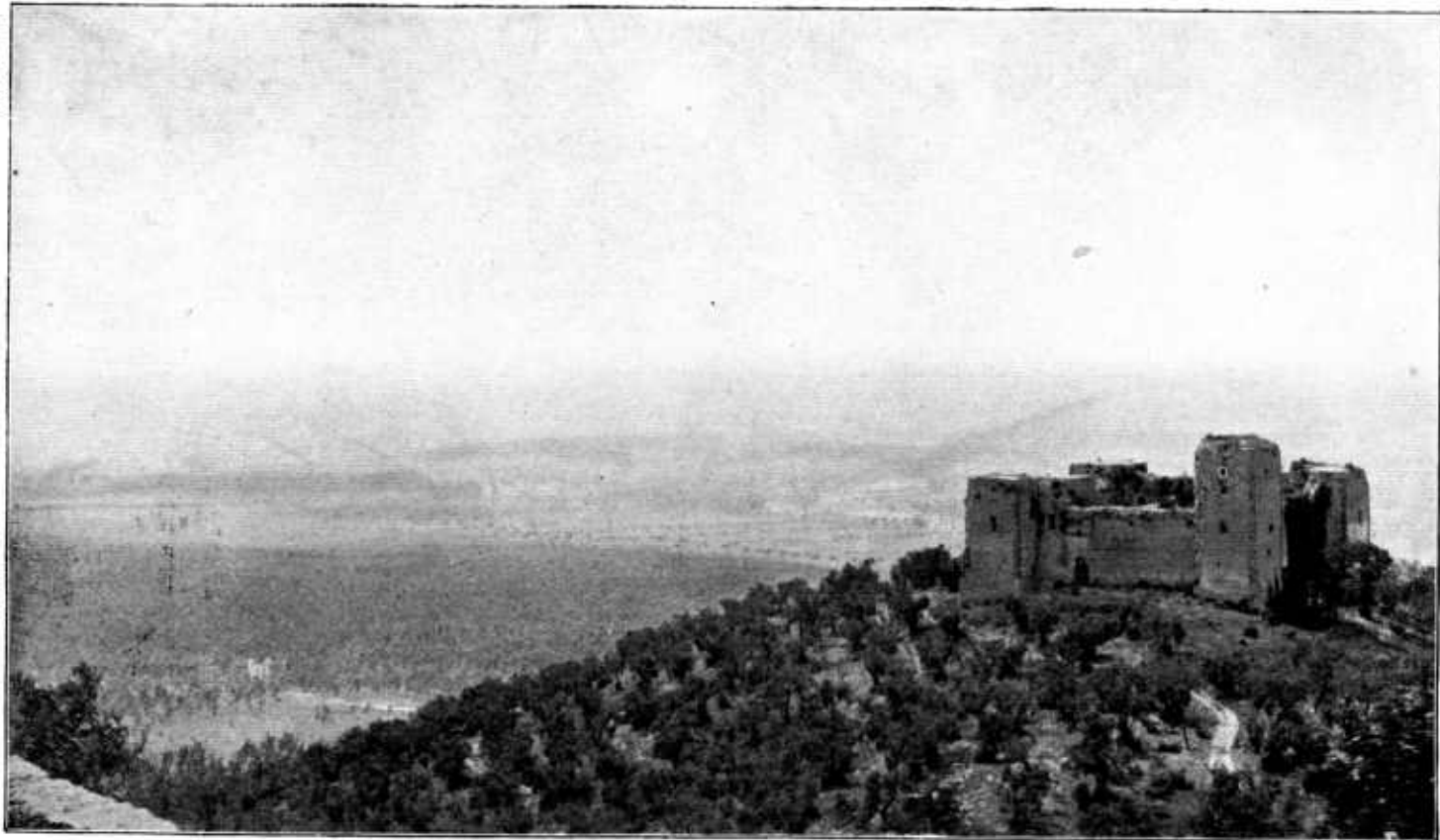
The conditions in the vicinity of Naples, Italy, are a little different. **During the summer** there is usually a light shower or sprinkle about once a month. Irrigation is practiced for garden truck and citrus fruits, but not for other trees or vines. An account of the system of growing the olive on the steep and high hillsides back of Naples is here introduced as likely to be of value to Californians. The hills are too steep and rocky to admit of being cultivated, but nevertheless they have maintained thrifty olive groves for ages. The olive groves now covering these hills are not the original growth, the old, or original, trees having been cut back and the present trees grown from the margins or sapwood of the large stumps. The stumps of the original trees that covered these hills are from 2 to 5 feet in diameter. The surface of these hillsides is so prepared as to retain all the rainfall of the year and cause it to settle into the earth at the roots of the trees. To accomplish this the trees on the hills are planted at the apex of V-shaped excavations in the earth surface, the earth taken from the excavation being thrown into two ridges, which extend upward and outward from the tree. The tree is usually planted just below the V-like ridge of earth, so that when the excavation is filled by the rains of winter or spring the water will not stand about the trunk of the tree, but will gradually settle into the earth underneath it. The following diagram illustrates this method of culture, the V showing the ridge of earth and the dot indicating the position of the tree:



It will be seen that in case of a heavy winter rain the excavations of one row of trees extending horizontally around the hillside must be filled with water before any can escape to the excavations for the trees in the row below, and so on to the bottom of the hill. Hence, if the excavations are of sufficient capacity the entire precipitation of any rain storm may be forced to settle into the hillside and as near the base of the tree as desired. It is to be hoped that a fair trial of this system of olive culture will be made upon the drier and steeper hillsides of the Coast Range of California, as it appears to be very successful in Italy on hillsides too steep for cultivation. (PL. VI.)

In this connection it may also be well to call attention to the fact that throughout southern Europe it is generally held that the quality of oil produced from hillside groves is superior to that produced from groves in valleys.

To further strengthen the claim that the olive may be grown with success upon the driest California hillsides, the writer calls especial attention to the olive groves of Mr. Cooper, at Santa Barbara. Here the olive is now grown with marked success upon hills consisting of all kinds of soil and at all inclinations, and without any irrigation



HILLSIDE OLIVE CULTURE NEAR NAPLES, ITALY.

whatever. One of these groves, on a black adobe hillside, is 20 years old, has always produced well, and has never been irrigated.

DISTANCE AT WHICH TREES SHOULD BE PLANTED.

Full-grown olive trees often have an expanse of top from 50 to 100 feet, and must therefore have an abundance of room. The distance at which olive trees should be set from each other is a relative matter, depending on whether the grower is planting for ten, twenty, fifty, one hundred, or two hundred or more years of growth. If soil conditions are favorable, and time enough is allowed, the trees should be set 100 feet apart. The first ten years they may stand 20 feet apart, the second ten it would be better if they were 30 feet apart, and for the third ten a greater distance may be necessary. Like most fruit trees, olives will be of better form if set at a considerable distance apart, and will also make a better and more rapid growth, because the root system is not crowded.

Observations of closely and widely set orchards and vineyards, and a knowledge of the necessity of the olive receiving a stated number of heat units to mature its fruit, seem to indicate that it is better to set the trees at first 30 by 30 feet, provided it is not intended to remove some of them as soon as the growth of the orchard may require. When the trees are set close at the start, there is danger that they will not be thinned out until crowding has stunted them or injured their habit of growth. Considering, therefore, the requirements of the olive in the way of sunlight, air, root room, and cultivation, the need of spraying, the desirability of growing the tree in an open, spreading form, the fact that most fruit occurs on the lower limbs where most shade is encountered, and finally the convenience of picking when the tree is pruned to spread, it is thought best to recommend that 30 feet be allowed between the trees from the start. Planting the small olive trees a considerable distance apart does not preclude the profitable use of the land. While the trees are small it is a commendable practice to grow among them annual crops, such as corn, beans, potatoes, and vegetables of all kinds. In this connection we may cite the oft-quoted Italian saying, "It is well to wed the olive to the vine."

PLANTING.

The olive tree may be transplanted at any age until the tree is 6 inches or more in diameter. . Trees from 10 to 20 years old may safely be set in orchards. The younger the tree the more care it requires. One-year-old trees are apt to be soft and sappy and the loss in transplanting from the nursery to the orchard is much greater than if the trees were older. The writer, from his observation, would recommend 3-year-old trees, as these are usually better supplied with fibrous roots and their roots and stems are hardened. The olive is a

rather difficult tree to transplant, and until it gets started should be given the same careful attention as the orange tree. After starting, there is no fruit tree which will stand so much abuse.

Before planting, the ground should be thoroughly plowed to a depth of, say, 12 inches, and all clods should be mashed. The excavations for the trees should be sufficiently large for the roots, which must be given a downward trend. The width and depth of these excavations should be not less than 18 to 24 inches. The root system of trees 2 to 3 years old should be well preserved and as complete as possible when transplanted. Broken or injured parts may be cut away with a knife. After digging the trees, the roots should be kept wet and covered with earth and the transplanting should be done as quickly as possible. As soon as the trees are planted, they should be thoroughly irrigated. If it does not rain, this should be repeated in about a week, then in two weeks, and again in a month. When the trees start they should receive about the same amount of water as a deciduous orchard. The soil should be kept pulverized to retain moisture. On dry land the trees should be given about two pailfuls each of water when planted and the same amount three or four times during the first summer.

The planting of trees for an orchard should take place early in the winter, or as soon as possible after the first heavy winter rains, so that the trees may get the benefit of all the precipitation and thus be as well prepared as possible to stand the heat of summer. January is probably the best month for planting olives, although they are also planted in February and March. The tree should be as nearly dormant as possible when transplanted.

PRUNING.

Olive pruning depends so largely upon variety, exposure, climate, and other local conditions that only some of the more general principles may be properly considered in this brief article.

After the nursery tree is set in the orchard it should be staked, but should not be pruned to any extent until it has established a good root system. An abundance of foliage is required to feed the roots and make the tree stocky. Close pruning of a tree in this stage of growth checks the development of the root system by cutting off its food supply, and the reduced growth of roots reacts upon the growth of the top. After the trees have reached a suitable height they should be headed back so as to establish the height of the trunks. In California the consensus of opinion appears to be in favor of low-headed trees (those measuring only 24 to 36 inches from the main forks to the ground). The number of branches left for main limbs may vary from four to six. All suckers and shoots below the forks should be removed as soon as the foliage of the main limbs is sufficient to protect the trunk from the sun. The main limbs are now allowed to reach a length of 2 feet or a little more, at which length the end of the branch is pruned off,

and likewise the ends of such terminal branches as project downward from these, one or two end branches being left to grow upward and outward. These secondary branches are in turn shortened back by having their leaders pruned as soon as they are 18 to 24 inches long. At the ends of these secondary branches are now preserved two lateral twigs, known as tertiary branches. These should be twigs which will grow upward and laterally. By the time they are well grown the form of the young tree is established, and further pruning for form may be done in a general manner to obtain the following results: (1) Maintenance of a comparatively open center to the tree; (2) exposure to the sun and air of as large a number as possible of last year's branches around the circumference of the tree; (3) removal of all ground suckers and water sprouts; (4) preservation of outward-growing and drooping basal and lateral fruit branches; (5) heading back of upward-growing limbs, which consume much, but produce little; and, (6) the removal of all diseased or injured wood. In pruning for form the rules governing pruning for fruit should be kept in mind (fig. 91).

The annual pruning for fruit requires different methods from those already described. The bearing wood of the olive, except in the case of a few varieties, is that of the preceding year, that is, the growth of one summer blooms and bears fruit the following summer. This fact determines what branches should be preserved for fruit bearing. While the growth of last year is bearing fruit this year, it will also send out new lateral and terminal shoots which will bear next summer, but the oftener a branch has fruited the less will be the new growth and consequently the smaller the yield of the next year. Hence, by pruning away each winter a portion of the fruiting branches which have produced crops for two or three years, new fruiting branches will be forced from the old wood. This new growth is induced with greater ease in the olive than in the peach, the latter having wood which bears fruit in much the same manner. The location of branches to be preserved for fruit bearing should be low, as the lower branches are more apt to produce than the upper ones, and besides the fruit is more easily gathered.



FIG. 91.—Young Mission olive, showing method of pruning.

Unpruned or imperfectly pruned olive trees have a tendency to fruit but once in two years. This habit may, however, be greatly modified, as already indicated, by the judicious annual removal of those branches which have already produced two crops. Some varieties are more readily induced to bear regularly by this system of pruning than others.

POLLINATION.

This subject was called into prominence by a bulletin on pear pollination by Mr. Merton B. Waite, of the Division of Vegetable Physiology and Pathology. Mr. Calkins, of Pomona, has made a start in these matters, and Mr. Mills, of the Pomona branch of the California Experiment Station, has also made some interesting and valuable experiments. Mr. Mills's experiments have shown in a surprising manner the need for the cross pollination of some of our olives and the fact that other varieties are perfectly self-fertile. The method adopted by Mr. Mills was that of bagging branches of bearing age for half their length before the buds opened in the spring. As yet this work upon the olive has not been sufficiently extended nor sufficiently thorough to warrant special conclusions, but it has gone far enough to show that it is important, for it is very necessary that the grower should know which varieties require



FIG. 92.—Olive branches in fruit, showing a self-sterile and a self-fertile variety (branches bagged up to the horizontal line).

know which varieties require cross pollination and which will set fruit with their own pollen (fig. 92).

CHARACTER OF THE FRUIT.

A few words on this subject may be of interest to those who have never seen the olive growing and know it only in the pickled state. As in the case of the peach, the olive is either clingstone or freestone. The ripe fruit is neither green nor yellow, but has a deeply colored skin—dark red or purple, reddish brown, purplish brown, light brown, deep brown, purplish, bluish, or reddish black, or jet black, with or without bloom. The fruit, even when ripe, is decidedly bitter, and

for pickling is put through a special process to remove this undesirable taste. It should be stated, however, that a few varieties of olives are known that bear sweet fruits, which, when ripe, may be eaten fresh from the tree, and when dried are also very good. Of the sweet varieties known to the writer, the best is the Piru Sweet No. 1. Piru Sweet No. 2 also bears a sweet fruit, and in these two imported varieties, of unknown origin, California has acquired two most valuable additions to the olive varieties now on the coast.

As is well known, olives vary greatly in size. The smallest are not as large as Malaga grapes, while the finer varieties of olives for pickling almost rival the size of our larger plums. The Sevillano, or "Olive of the Queen," as grown in the vicinity of Seville, Spain, frequently reaches a length of $1\frac{3}{8}$ inches and a breadth of $1\frac{1}{8}$ inches, while in California the same variety reaches even larger dimensions. In this connection it may be said that many varieties of olives bear larger fruits when planted in our virgin soils than they do when grown in the Old World.

The oil content of the olive also varies greatly, both in quality and quantity, in different varieties, and sometimes also in the same variety under different soil conditions or other influences. For pickling, the olive is usually plucked while green; for oil, it is allowed to hang on the tree until it is nearly ripe, which in California, for most varieties, is usually not until December or January. The olive tree begins to bear fruit when it is four, five, or six years old.

SELECTION OF VARIETIES FOR PLANTING.

In spite of the double dealing of some of the agents in foreign countries, who have been relied on to supply certain of the more valuable olives, and who in several notable cases have failed to fulfill their engagements, the numerous importations from many localities have now brought into our olive belt most of the more valuable varieties of olives of the Old World. This is encouraging, and assures us that the pick of the fruits of the world may be had by proper and persistent effort. The fruits of about eighty varieties of olives have been examined and photographed by the writer in California, and still other varieties are growing there which have not yet fruited, or at least not generally enough to enable one to judge of their quality.

In selecting olive varieties growers usually have two things in view—oil and pickles. Among the main considerations to be taken into account when selecting varieties for oil are quality and quantity of oil produced, prolificness, regularity of bearing,¹ early maturity of fruit if growing in a region where there is danger from frost, maturing of the fruit at different dates if growing in a region where frost is not feared, even ripening of the fruit upon the tree, and hardiness of the tree against cold and drought. When selecting varieties

¹See remarks on pruning for fruit, p. 381.

for pickling, the features for consideration, among others, are size of fruit, firmness of flesh when nearing maturity, form of fruit, uniformity in size and shape, even ripening of fruit upon the tree, prolificness, regularity in bearing, thickness of the skin and the quality of the fruit when pickled, and hardness of the tree with respect to cold and drought.

Before selecting varieties for planting it would be well for the planter to consult a number of successful olive growers with special reference to the success of given varieties on the kind of land which he intends to plant and in the region which he has selected. In addition to these suggestions a few words may be said on particular varieties.

The following varieties of olives are believed to be among the best for oil, the names being those under which they were received by the writer or under which they are generally known in California, but

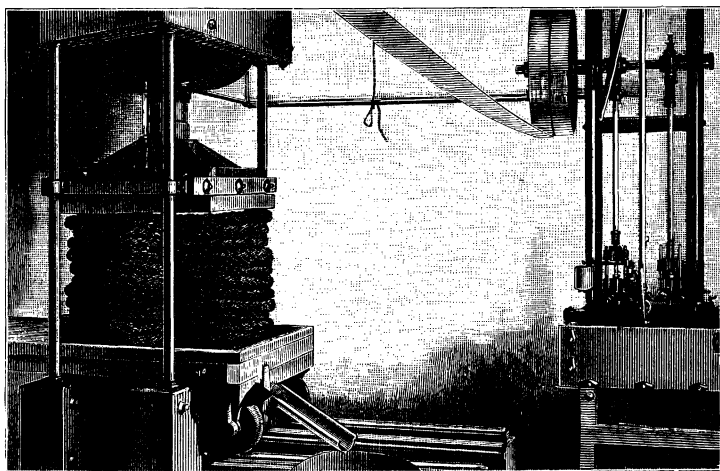


FIG. 93.—Hydraulic olive press.

which perhaps are not always correct, as a good deal of uncertainty exists as to the proper names of many varieties of olives grown in California: Morinello, Infrantojo (Grossajo), Leccino (very resistant to cold), Razzo, Oblonga,¹ Uvaria of Mr. Loop (ripens early), Rubra, Morajolo (requires rich soil), Correggiolo (requires rich soil), Frantojo (said to do well on hills), Piru No. 1 (ripens early in November), Nevadillo Blanco, and Mission. The following are especially excellent for pickles: Ascolano, St. Agostino, Oblonga, Sevillano, Picholine, Manzanillo No. 1 of Mr. Roeding (not of Tablada), Lucques (ripens very early), Ojo de Liebre (?) of Mr. Rock, Nevadillo Blanco, Mission (fruit small), Macrocarpa (only for warm, dry, and elevated situations;

¹In 1894-95 a 5½-year-old tree of this variety at Biggs, Cal., bore the heaviest crop of any tree of its age which has come under the observation of the writer, its product being 52 gallons of fruit.

ripens in October), and *Palymorpha* of Roeding. The two last named are quite apt to decay at the pit.

EXTRACTION OF THE OIL.

The extraction of oil from the olive is a purely mechanical process. In California two general plans are followed in preparing the olive pulp for the press. One is to grind the pits of the fruit with the flesh, and the other is to grind the flesh from the pits without crushing the latter. As the result of experience and various chemical analyses, it has become quite generally understood that the pit contains little oil, and that the practice of grinding it with the flesh tends to detract from the quality of the output.

Most of the mills now used for preparing olive pulp are made of cast iron, the crushing being done by a series of rollers. The presses used for extracting olive oil are of many patterns. Some growers use powerful screw presses, while others prefer the hydraulic press. Homemade lever presses, like the old-fashioned cider press, are still in use by some, and can be relied upon to do good work (fig. 93).

The olive pulp as it comes from the mill is placed in sacks for pressing. There are several styles of sacks in use, the French being made of fine fibrous grass, while those preferred in Italy and Spain are of coarser material and looser construction. The sacks are made in the form of a cheese, and are open at the center of the top and bottom for filling and cleaning. In preparing for pressing, a series of wooden slats, forming a kind of grating, is first laid on the bottom of the press. Over this is placed a perforated, circular plate of iron, on which is laid one of the grass mats or sacks. The pulp is then crowded into the sack until it is full. Upon the first sack is placed another perforated iron plate, more wooden slats, and then another sack to be filled. This is continued until six or eight sacks of pulp are placed one above the other ready for pressing. A number of California growers do not use grass sacks on account of the difficulty of keeping them thoroughly clean, but instead employ a Russian crash, cut into circular pieces about 3 feet in diameter. A galvanized-iron hoop, of the breadth and depth of the cheese desired, is first placed on the wooden grating. Over the top of this hoop is spread the piece of crash, and upon it is poured the olive pulp until the hoop is packed. The sides of the cloth are then turned over the pulp and the hoop is withdrawn. A slat grating is now placed on the cheese and the process repeated.

The first pressing of the olive pulp is done slowly and with caution, and the resulting oil, which is frequently known as virgin oil, is usually, on account of its superior quality, kept separate from that of the second and third pressings. When the oil ceases to flow after a thorough first pressing, the pulp is removed, left until next day, and

then reground and re-pressed. If desired, water may be added to the second pressing, but the oil thus obtained is of inferior quality. A third crushing and pressing, with the use of hot water, may be given to obtain the little remaining oil, which is of the lowest grade.

The subsequent clarification of the oil involves two general processes, namely, its separation from the watery juice of the fruit and from fragments of tissue by means of gravity, and a special clarification by means of filtration. There are scarcely two mills in this country which use the same vessels for the separation of oil. The form of the settling tanks, as well as their size and the material of which they are made, varies widely. Tin, wood, or stone vessels may be used successfully if kept perfectly clean. Tin vessels are probably most commonly employed, though some producers insist that white oak tanks are better. Whatever form or kind of vessel is chosen, the expressed olive fluids are allowed to stand in it until gravity has caused the oil to rise to the surface. As the oil rises it is either removed and placed in other similar vessels for further separation of impurities or else is stored in tanks to remain till ready to bottle.

The process of clarification by filtration, which usually follows the separation of the oil by gravity, varies. The clearest and most brilliant oil is, however, usually obtained by passing it through some compact filter, such as is used for filtering spirituous liquors, or the firm, gray filter paper commonly sold in circular sheets by druggists. A less brilliant oil may be obtained by passing it through more porous filters. It is even probable that oil bottled without filtration, if thoroughly cleared by standing at a proper temperature for a sufficiently long time, will be of a finer flavor than that passed through filters.

Cleanliness is a most essential feature in making olive oil, as this oil readily absorbs all taints and odors. No offensive smell and no tobacco or smoke of any kind should be allowed about the oil house, and everything in the building—mills, presses, cloths, dishes, tanks, etc.—should be kept scrupulously clean by washing daily with boiling water, and when possible with lye also.

In all the processes of expressing and handling olive oil it is important that it be kept at a moderate and uniform temperature and that it be not exposed to the light more than is necessary.

The gathering of olives at a proper stage of ripeness is an important feature of the olive industry. The olives should not be allowed to hang too long, but should be gathered while red. The best oil comes from olives not overripe. With late varieties there is also the advantage in early gathering that much risk from cold weather is avoided. Olives which have been frost-bitten should be sent to the mill at once. In gathering, the olives should not be allowed to remain on the ground more than a few hours, if at all, and all imperfect and bruised fruits should be culled out, as well as those which are overripe. The latter

may be put through the mill by themselves and the product kept separate. The fruit should be picked at a stage of ripeness as nearly uniform as possible. After being gathered, the olives should be spread out on trays in thin layers, so that the air may circulate freely among them, and the trays should then be kept in a dry, clean, and airy room. The fruit on the tray should be turned over every two or three days for twelve or fifteen days, or until it is properly dried, after which it is ready to be reduced to pulp in the mill.

OLIVE PICKLES.

The pickled-olive industry of California is growing rapidly from year to year. Two classes of pickles are prepared—the green and the ripe. Green olive pickles are more easily made than ripe ones, and, as a rule, will keep better. As a food, however, they are incomparably inferior to pickles made from the mature fruit, the oil of the ripe olive adding very greatly to its nourishing qualities and to its flavor. For consumption within the year nothing but mature fruit should be put up. Ripe olives may also be kept for several years if sufficient care is given to the pickling. For long keeping and for shipment the immature fruit is often preserved, especially by Europeans.

In gathering mature olives for pickling, they should be as nearly as possible of uniform color and ripeness, and it is desirable to pick them into water so that the fruit will not be bruised. The mature fruit should never be overripe, but for the best results it should be gathered while still firm and hard. Following the pickling of either mature or immature olives it is well to hand grade them for size and color and always into water.

Nearly all fresh olives are exceedingly bitter, and if preserved in that condition would be unfit for food. There are two methods in use for removing this bitter taste. One is to destroy or neutralize it by the use of strong alkaline solutions and the other is to wash it out gradually by the long-continued use of fresh water. The former method is that now most generally practiced by olive growers. The details of this process may be sought in special treatises, as it differs among different growers. It consists essentially in subjecting the fruit for some hours to the action of a solution of water and concentrated potash lye. This is usually in the proportion of 1 pound of lye to 8 to 10 gallons of water. The olives are allowed to remain in this solution until all bitterness is removed, or until the alkali has penetrated to the pit, which can be determined by the change in the color of the flesh. If one soaking only is given, it requires at least twenty-four hours, the fluid being agitated at frequent intervals by drawing off some and pouring it back so as to keep the fruit from spotting. When the bitterness is gone, the alkali is removed by soaking the fruit for a week or more in water, which is renewed quite frequently the

first day and at least once every twenty-four hours thereafter. Litmus paper may be used to determine when all the alkali has been removed. The fruits are now covered with a weak brine, which is allowed to remain on them for a week or so, and then with a stronger brine. Mr. Lelong advises three brines, containing, respectively, 4, 8, and 14 ounces of salt per gallon of water. To prevent the olives from becoming rancid, this strong brine must also be changed after it has become colored by the pulp of the fruit. If strong brine were put on at first, the olives would shrivel and be spoiled. To avoid a dangerous softening of the fruits, especially the riper ones, Mr. Lelong recommends two or three soakings in the alkaline solution, each for four hours, the olives to remain in the fresh water for several days between each treatment. During these treatments great care must also be taken that the fruits do not become crowded together and squeezed and in this way become disfigured and unattractive. This is best prevented by treating them in shallow vats. After the scum has ceased to rise from the brine, the olives are ready to bottle or to store in kegs. The brine used for bottling is of the same strength as the last used in pickling.

The process of extracting the bitterness of the olive by means of pure water usually lasts from thirty-five to sixty days, and during this time the water should be changed twice a day to prevent the development of bacteria and the spoiling of the fruits. In this process pure water is a great desideratum, and the value of distilled or boiled water can not be overestimated. No oil is lost by this process, and it also has the advantage of preserving the natural taste of the olive to a much greater degree, thereby insuring more delicious pickles.

This process of curing the olive, however, is not popular, owing to the amount of time and attention required to insure success. In this connection the writer would suggest that if artesian or spring water can be had and if the tanks are properly arranged with inflow and outflow traps or valves the amount of time required from the grower can be reduced to less than is required by the lye process. It would be a very simple matter to so arrange the water supply that a barrel could be drawn from the bottom of the tank every hour or two and the same amount allowed to enter at the same time at the top, direct from the spring or other source of supply. If the inlet is constant and limited, the valve at the outlet could be worked automatically by means of floats. The whole could be arranged after the manner of an automatic flusher and very little personal attention would be required. The main feature to be considered would be the proper arrangement of the supply pipes so that the water would always be too cold for the rapid increase of bacteria and would not be exposed to the air before its discharge into the vats.

At present pickled olives are put up on the Pacific Coast in bottles, kegs, half barrels, and barrels. Those put up in bulk are usually

sold to consumers by the quart or gallon. Prices vary according to quality and the laws of supply and demand, being commonly retailed from the barrel at from 15 to 25 cents per quart.

DISEASES OF THE OLIVE.

The diseases of the olive are quite numerous, but fortunately those most destructive to the fruit are not yet known in the United States. The most important olive trouble in this country, so far as observed, is the black scale (*Lecanium oleæ*). The control of this parasite may be most easily accomplished by treating the trees with resin wash at the time all the eggs have hatched. This will vary from year to year and in different localities, and should be determined by keeping careful watch of the insect itself, lifting the scale and examining it for the eggs, which are deposited beneath the parent insect. It will be found advisable to keep trees clean by early spraying rather than to delay until they are badly infested. One advantage of this is that it will prevent the tree from becoming infested with the sooty mold, a fungus which always follows the work of the black scale, and which is hard to remove from the foliage.

There are two insect enemies common in the Mediterranean region, which it is to be hoped may not reach this country. The more destructive of the two is a fly (*Dacus oleæ*), which stings the olive and the larva of which greatly injures the fruit. The olive crop is sometimes much affected in Italy, Sicily, and Spain, and to some extent also in France, by the depredations of this insect. The other insect is a moth (*Prays oleællus*), the larva of which feeds, according to the brood to which it belongs, either upon the leaves, the fruit buds, or the fruit. The larva of the last brood, which lives within the fruit, causes the latter to fall from the tree. The olive is greatly injured by each of these insects, as the writer can testify from personal observation, and every precaution should be taken to prevent their introduction into the United States. No fresh olives should ever be imported, and all truncheons, or cuttings, should be disinfected in a manner thorough enough to kill all eggs and pupæ which may be upon or under the bark.

A tubercular swelling of the smaller limbs and twigs is common in some parts of Europe, but as yet has not been seen in this country. It is due to a bacillus, and the disease may be spread by inoculation. The excrescences, or tumors, characteristic of the disease are quite variable in size, but in most cases they mature before being quite an inch in diameter. Many branches cease to grow wholly or in part beyond the swellings after the latter have become partially developed. Some branches become stunted, while others die entirely toward the end, hence, the growth of the tumor is largely limited by the life and vigor of the limb bearing it. As a means of preventing its introduction, all imported olive branches should be carefully inspected by

someone familiar with olive diseases and all diseased branches or wood condemned and burned. There are many other European diseases of the olive due to fungi or insects or to physiological troubles. There are also several diseases of the fruit, leaves, and bark now present on the Pacific Coast, but none of these are at this time causing any serious losses.

[NOTE.—The Census of 1890 reported the total olive production of the United States the previous year as having a value of \$386,368 in the primary market. The whole of this production was reported from the State of California, which, with 278,380 olive trees in bearing, contained within its boundaries the entire olive-growing industry of the United States. Of these trees, 79,208 were in Los Angeles County, 58,340 in Sonoma County, 29,688 in Alameda County, 22,747 in Santa Clara County, 20,595 in Fresno County, and 10,436 in Butte County, the remaining 57,366 being distributed over 31 counties, extending as far north as Tehama, with 1,673, and Shasta, with 687, trees in bearing. The Eleventh Census also shows there to have been at that time 331,022 olive trees set out that had not yet come into bearing, 328,997 of them being in California, and the remaining 2,025 in Arizona. Although these trees should in the ordinary course have doubled the crop during the period that has since intervened, the imports of olives during the last seven years have been annually from one and one-half to two and one-half times as great as they were in the census year, when they amounted to \$211,817, or less than three-fifths of the value of the domestic crop. The imports of olive oil, or what passes for such, were greater in the fiscal year ending June 30, 1896, than ever before, being 942,598 gallons, of a declared value of \$1,107,049. These various figures indicate the large possibilities that attend the cultivation of the olive in the United States.—EDITOR.]